



Guam Memorial Hospital Wind Mitigation

Full Mitigation Best Practice Story

State-wide, Guam

Guam - The U.S. Territory of Guam is the largest and southernmost island in the Mariana Islands archipelago. Many typhoons form in the western Pacific Ocean, and in the past 50 years more than 25 typhoons have struck the island.



On December 16, 1997, Typhoon Paka, noted as one of the most powerful storms of the Twentieth Century, struck the island with sustained winds of 150 miles per hour and gusts to 185 mph. Paka's winds impacted the island for 12 hours, creating a much longer than usual timeframe for wind, rain, and storm surges to cause damage. The northern and central sections of the island sustained widespread damage to homes, the island's power grid and public utilities, privately owned buildings, and many other structures, including the Guam Memorial Hospital (GMH), suffering more than \$1 million in damage.

Guam Memorial Hospital is the only civilian inpatient facility on the island and the only healthcare facility that remains open during and immediately after typhoons. During such events, GMH becomes the only dialysis unit, lab and source of oxygen available. Because of its critical importance, Guam officials decided to take steps to prevent similar damage caused by future typhoons or storms.

Two such projects were funded through the FEMA Hazard Mitigation Grant Program (HGMP). The largest involved enclosing several areas of the facility at a total cost of \$4.3 million. As part of this project, two open corridors on the ground floor were enclosed. A smaller, but equally important project was the strengthening of the oxygen storage facility by covering it with a chain link mesh that serves to deflect and repel flying debris. The one-time cost of replacing the roof of the oxygen storage facility and the liquid oxygen tank, and for using portable cylinders until the new tank was put in place, was \$988,560. The cost of hardening the oxygen storage facility was \$51,550.

On December 9, 2002, Typhoon Pongsona hit Guam, but GMH was ready. The areas of the hospital that were fortified after Typhoon Paka successfully braved the storm, including the following:

- Rear Stairwell - With elevators out of operations due to no power and damaged generators, the stairs served as the only way to move about the hospital. It sustained only minor water damage during Typhoon Pongsona.
- Enclosed Elevator Lobbies - These spaces were used as storage, staging and recovery areas during and after the typhoon.
- Enclosing The Rear Courtyard - This area was a hazard during Typhoon Paka as cyclonic winds formed in the open space. Now enclosed, the area was one of the most secure in the hospital during Typhoon Pongsona and served to store equipment and temporarily house patients who were evacuated from unsafe wards.
- Enclosing Third And Fourth Floor Solariums - This formerly glassed in area was an extreme hazard making the wards on the third and fourth floor extremely vulnerable during previous storms. These wards were safe and able to continue functioning after the typhoon.

During Typhoon Pongsona, no damage was sustained in these enclosed corridor areas, providing safe passage to the facility by staff and patients. Minor damage occurred to the chain link mesh of the oxygen storage facility, but there was no disruption to the availability and accessibility to medical grade oxygen. The benefit/cost ratio for this project is 20:1.

Hospital staff was universal in their praise of these mitigation projects. Having enclosed areas allowed the hospital staff to move patients from three different floors into other spaces that during previous storms were inaccessible or did not exist.

The expectation is that there will be none or minimal damage from the next typhoon and thus no further repair or replacement costs. Risk analysis shows the benefit of this work is valued at \$4,768,188, a benefit to cost ratio of 2:6.

Activity/Project Location

Geographical Area: **State-wide**

FEMA Region: **Region IX**

State: **Guam**

Key Activity/Project Information

Sector: **Public**

Hazard Type: **Typhoon**

Activity/Project Type: **Retrofitting, Structural**

Structure Type: **Concrete, Reinforced**

Activity/Project Start Date: **02/1998**

Activity/Project End Date: **11/1998**

Funding Source: **Business Owner; Hazard Mitigation Grant Program (HMGP)**

Funding Recipient: **Critical Facility - Medical**

Funding Recipient Name: **Guam Memorial Hospital**

Activity/Project Economic Analysis

Cost: **\$1,919,612.00 (Estimated)**

Activity/Project Disaster Information

Mitigation Resulted From Federal
Disaster? **Yes**

Federal Disaster #: **1193 , 12/17/1997**

Value Tested By Disaster? **Yes**

Tested By Federal Disaster #: **No Federal Disaster specified**

Year First Tested: **2002**

Repetitive Loss Property? **No**

Reference URLs

Reference URL 1: **<http://www.fema.gov/government/grant/hmgp/index.shtm>**

Reference URL 2: **<http://www.gmha.org/>**

Main Points

- Guam Memorial Hospital (GMH) is the only civilian acute care hospital on this island.
- Enclosing the stairwells and hardening the oxygen storage facility allowed the hospital to function following the next typhoon.
- Maintaining staffing pattern history and analyzing the data resulted in more efficient staffing and reduced costs.

